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ABSTRACT

A unifying methodology of diffusion studies is presented treating geographical, sociological, and historical phonomena of language within the same framework. Patterns of linguistic innovation and the social and psychological motivations for such a change, both in the individual and in society, are summarized in their functions as predictors of language diffusion. The theory and method of language diffusion examined in this multi-dimensional, interdisciplinary framework provide the means for a quantitative analysis and simulation with a view of forging precise methods of language planning. The manner in which an individual adopts an innovation is precisely delineated on Rogers' model (1962). Hagerstrand's matrix of social communication (1962) provides the basis for the discussion of the geographical aspects of language diffusion. These and other on-going studies should soon produce a model for prediction of language diffusion that in turn will be effective in planning language policies. (PMJ)

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DIFFUSION PROCESSES IN LANGUAGE:

PREDICTION AND PLANNING

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DIFFUSION PROCESSES IN LANGUAGE: PREDICTION AND PLANNING

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Introduction *

Linguistic variation involves several dimensions. Variation in space has been the concern of traditional dialectology, later, linguistic geography and more recently areal linguistics. The new field of sociolinguistics has provided an insight into verbal variation due to social structure, in addition to examining the dynamics of shifting from one language to another. Finally, historical linguistics has treated variation as a function of time, usually over considerably long increments. Until now, an attempt to treat language variation in a multi-dimensional space defined by the above dimensions has not been made. Yet it is obvious that geographic, sociological and historical phenomena of language are closely related, and are never just geographic or just historical.

In the present paper, a unifying methodology, that of diffusion studies, is explored, with the aim of treating these related phenomena within the same framework. But more than its coverage of a wide range of phenomena, the theory and method of diffusion provides the means for a quantitative analysis and simulation, with a view of thus forging precise methods for language planning.

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Some of the ideas in this paper were discussed in a paper presented at the *Phonology Festival. 1970*, University of Hawaii (January 15th, 1970), under the title: "When Tongues Meet . . ." I have profited greatly from discussions with Burkhard Ortmann, now of the Geography Department at McGill University.

1.0 Language Change

In language change phenomena are comprised several distinct processes:

1) change in a linguistic code (:not homogeneous but with sociolinguistic diversity) due to internal forces;

2) change in the linguistic code motivated by contact with another code (code-switching/convergence);

3) change in the choice of the language code (language, dialect, style, etc.).

1.1 Internal Change

In this work we will study the linguistic motivation and inception of innovations only marginally. We will concentrate, instead, on the process of propagation of innovations in the speech community till they become part of the linguistic norm. It should be mentioned that this norm can be, and most often will be, context-bound: it will depend on domain (or situation) of use, roughly style, etc.

Operationally, I will adopt the scheme developed by Weinreich, Labov and Herzog (1968: 183 ff.).

Language change entails the following:

1) the constraints problem

2) the transition problem

3) the embedding problem

a) in the linguistic structure

b) in the social structure

4) the evaluation problem

5) the actuation problem.

Of these, (3a), the central concern of most diachronic linguistic studies will assume only peripheral status here. The others are all implicated in the framework to be proposed. Reference to them and brief explanations will be made in the section on social diffusion.

1.2 Change Motivated by Contact

Again, the linguistic aspects of code-switching, borrowing and convergence will be examined only peripherally. If innovations are considered at the point where some speakers of Code A are exposed to and adopt elements of Code B, the subsequent process will be similar to the above, with variations in some parameters. For example, attitude to the innovation in some cases will not be the same to foreign elements in diffusion and to internal innovations (whenever these can be identified by the subjects as to origin). At some stage, we will have to identify the transfer elements, as well as the actual result. The former can be tentatively treated by some existing method. The same parameters might be shown to govern the latter, as those governing the propagation of the

innovations in the community: dependence of form of lexical acculturation on the nature of the cultural contact and the resulting social attitudes comes to mind here.

Traditional contrastive analysis and some more recent work treat the problem of interference. For instance, Tzannes and Afendras (1970) have proposed a stochastic model for sound patterns which could predict phonological interference.

Lexical borrowing is more intimately bound to topic, domain, and role, therefore might best be treated in a paradign which would incorporate these notions.[1)] The question of integration of received elements into the receiving code has been approached by Mackey (1970).

Integration is reflected in the availability of a received item relative to the indigenous equivalent, in a corpus elicited from a target population.[2)] It is possible to assign conceptual fields to given domains and thus procure data on the lexical content of domains. Texts recorded from actual verbal activity relevant to the domains provide another natural source of data.

1.3 Language Shift

One can view language shift from different analytic "distances"; the grossest view, from the greater distance, would consider two communities A and B, one with Code a, the other with Code b, at time t; Community A+B with Codes a and b at time $(t+1)$;

and finally Community A+B with Code *b* at time (*t*+2). We have in other words first an adoption of an innovation and subsequently the rejection of its original counterpart. However, a closer look at language shift shows that it does not work by overnight addition of a second language and a bit later elimination of the mother tongue. Instead, different domains fall at different stages in the process of linguistic assimilation and Fishman (1969:15) points out that occasionally a role within a domain might remain intact, even when the domain has been "engulfed". The difference in the two treatments of language shift relates to different time increments within which we choose to operate. The smaller the time increment, the subtler the shift in code distribution. In treating language shift subsequently we will have to decide both the time increment and the unit of diffusion (i.e. unit of change) as they are two of the basic elements of the diffusion process.

Perhaps we can consider as innovation a role in the second language (in a specifiable domain). The individual possesses a cluster of roles, and in shifting will be repeatedly an adopter and simultaneously a rejector. Most bilinguals can then be said to be both (with respect to different roles and domains). To be even more precise, we can treat adoption of a *role-in-other-language* as one and rejection of *role-in-previous-language* as a different diffusion. Such a scheme allows for domain overlap, and can be made to reflect the possibly different motivation for adoption of bilingualism and

rejection of mother tongue. More details will be given subsequently in the exposition of the diffusion model.

2.0 The Individual Adopts an Innovation

> "The selection of psychological, social and cultural variables for the study of language maintenance and language shift may well be guided not only by impressions of what seem to be the most relevant processes in a particular contact situation but also by more general theories of personal, social, and cultural change." (Fishman, 1969:25).

A theory of diffusion provides such a framework for analysis and, as indicated above, can handle simultaneously changes in the language code, both internal and contactual. As a start, the paradign of diffusion outlined by Rogers (1962:306) will be outlined and its applicability to linguistic diffusion discussed. I do not intend to evaluate at this stage the relative faults or merits of this particular paradigm.

A key concept employed by Rogers is that of *situational fields*, "that part of the environment which is perceived by the actor as significant for him". These situational fields are notions analogous to the sociolinguist's *domains* or the anthropologist's *cultural activities*. Briefly, the following is the theoretical thinking in Rogers' model:

Individual behavior takes place in situations. Individuals belong to groups, and groups are characterized by involvement in a certain range of situations. The individual is submitted to normative pressure due to his interaction with others in situations. As a consequence, he adjusts his behavior in order to enhance his identity.

Five categories of individuals are distinguished according to their values — and the normative constraints to which they subject themselves:

innovators, early adopters, early majority,
late majority, laggards.

Some individuals are not totally restricted to their group's proper situations, thus bringing new, external elements to them.[3] (See also *Fig. 2.*) Rogers discusses in detail the values of each of the five types.

Various mathematical expressions for the growth of the diffusion once the innovation is introduced into the community have been proposed by different researchers (Coleman, 1964: 492 ff.).

In the antecedents are comprised the identity of the actor (:speaker) and his perception of the situation. The "dimensions" of the (speaker's or listener's) identity are significant in our case also, as they determine to a great extent aspects of verbal behavior.

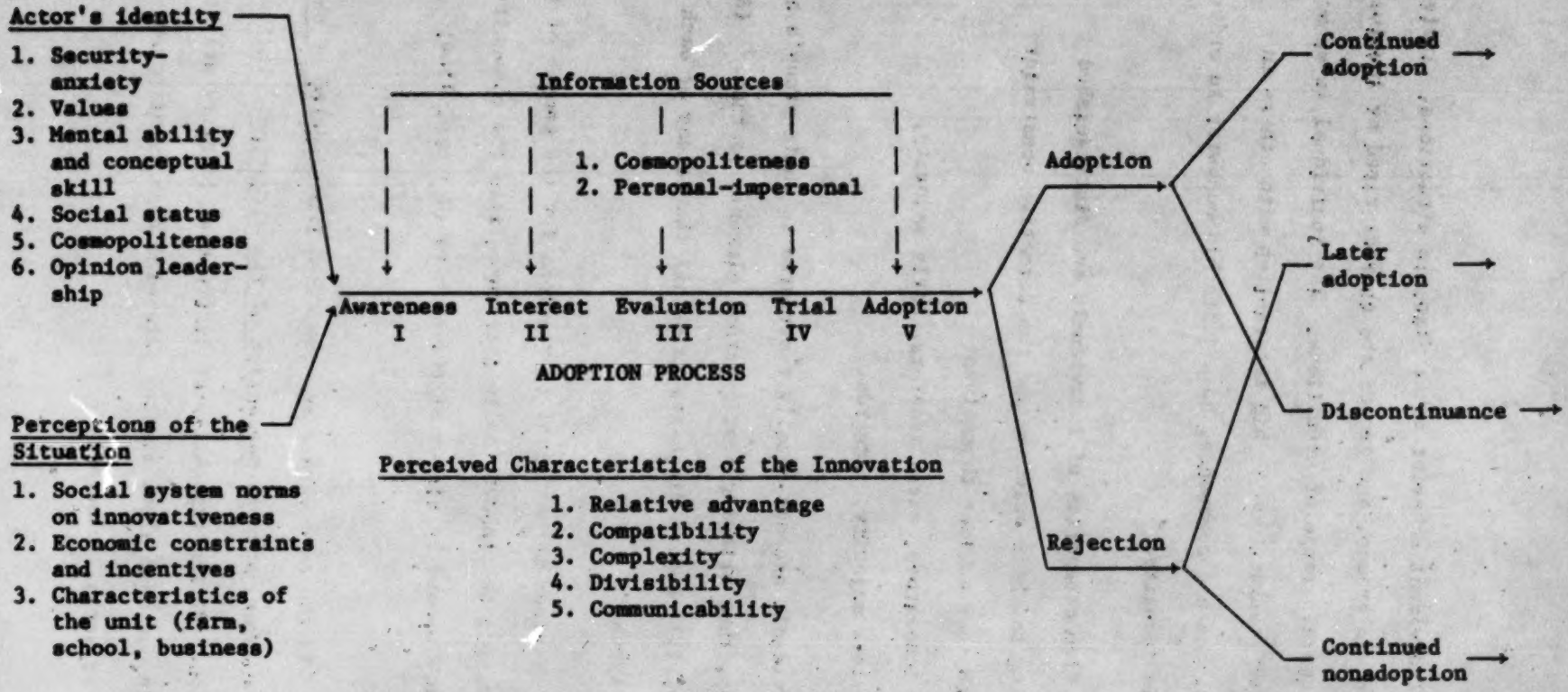

FIGURE 1. Adoption of an Innovation by an Individual within a Social System. (From Rogers. 1962:306.)

The first two dimensions, security and values of the individual, are intimately tied. The speaker will seek relative well-being, both from his inner state and his interpersonal relations. But his values will strike the balance, or the point where these will meet. Whether he adopts a new verbal form thus standing out, or whether he awaits for the form to become typical of his group before he follows is also determined by his set of values. Is he *avant-garde*, does he seek respect from his peers, does he value careful evaluation or is he skeptical or scornful about everything new? What is his preoccupation with correctness of speech? The pertinence of these factors to questions of language shift or maintenance is also obvious.

Since learning is definitely dependent on intelligence, mental skills and conceptual ability are important factors in language diffusion. Prestige has been discussed in the sociolinguistic literature as a factor in language variation and change (e.g. Bright and Ramanujan, 1965) and covers an area roughly that of social status in Rogers' formulation. As is pointed out in sociolinguistic work, it is only one of the factors and cannot account for all of change or conservation.[5)] The remaining two elements of an individual's identity, cosmopoliteness and opinion leadership, are significant in determining the course of the diffusion process. Their role in impeding or advancing diffusion depends on other factors, but they certainly influence it.

We then examine the effect of the individual's perception of the situation as governed by his system's attitudes to change, the economic constraints-incentives and the character of the innovating unit as such [4]

There are societies (or groups) tolerant of neologism and others which suppress it, or limit it in form or otherwise. The role of economic considerations in language shift is extremely important; witness, for instance, the French Canadian who will learn English in order to enhance his economic opportunities, or the individual who will shed some of his dialect features for the same purpose.

Linguistic innovation differs from other innovations in that it is immediately dependent on verbal communication. Therefore the process stage of adoption also differs.

Information is mostly personal (although the mass media do play a role) and more than information about (the innovation), communication presents the individual with the innovation itself. More on the information component will be given in the geographic section. [5]

The perceived characteristics of the innovation touch on problems of central concern to linguists studying diachrony. Here belong, I think, the internal linguistic characteristics. Compatibility with the existing structure and integration into it,

roughly what Weinreich, Labov and Herzog (1968:185) include in the constraints problem; complexity of the new item would certainly affect the resistance to it, it is also part of the constraints. 6)

As was mentioned above (Section 1.3), language shift can be taken as a diffusion of *role-in-second-language* accompanied by a rejection of *role-in-first-tongue*. The bilingual individual is perceived as a *bundle of roles* and in a non-stable situation is in a state of flux: in some of his roles he has adopted (in some of them he has rejected the old), for the remaining he can be in any of the four stages before adoption (awareness, interest, evaluation, trial). He has been totally assimilated (i.e. has shifted) when in all of his roles he has adopted the other tongue and rejected his first.

The case of change is roughly similar. "Change takes place (1) as a speaker learns an alternate form, (2) during the time that the two forms exist in contact within his competence, and (3) when one of the forms becomes obsolete." (Weinreich et al, 1969:184).

In this case, divisibility of the units of innovation (i.e. the second language code) aids its diffusion.

3.0 Geographic Aspects

Spatial aspects of diffusion have also been studied and are of direct pertinence to linguistics, as they provide an insight into many traditional concerns. However, to concerns such as dialectology, areal linguistics and wave theories of geographic propagation we can add new fields, for instance urban linguistics, and new problems, such as the linguistic side effects of migration.[7)]

While our systematic language geography should delve into the variations in space (over time) of language phenomena (e.g. delimitation of distinct regions and the covariance of geographic, linguistic, and other variables), more specific problems will be approached here.

First, we will examine diffusion in space of linguistic variables, and its dependence on geographic and other factors. Thereafter, we will look into the spatial distribution of various "services" and cultural manifestations and in the planning stage, the optimal location, internal organization and reach of such.

In the geographer's terms space diffusions have the following elements: (Brown, ditto:9)

(1) an area or environment

(2) time

(3) an item being diffused

(4) places in which the item is located at the start of a time interval (nodes of origin)

(5) places in which the item is newly located at the start of a time interval (nodes of destination)

(6) paths of movement, influence, or relationship between origin places and destination places (edges).

The most important work in spatial diffusion along such lines is due to Hägerstrand. His conceptualization of the networks of social communications is shown in *Figure 2* and the citation that follows.

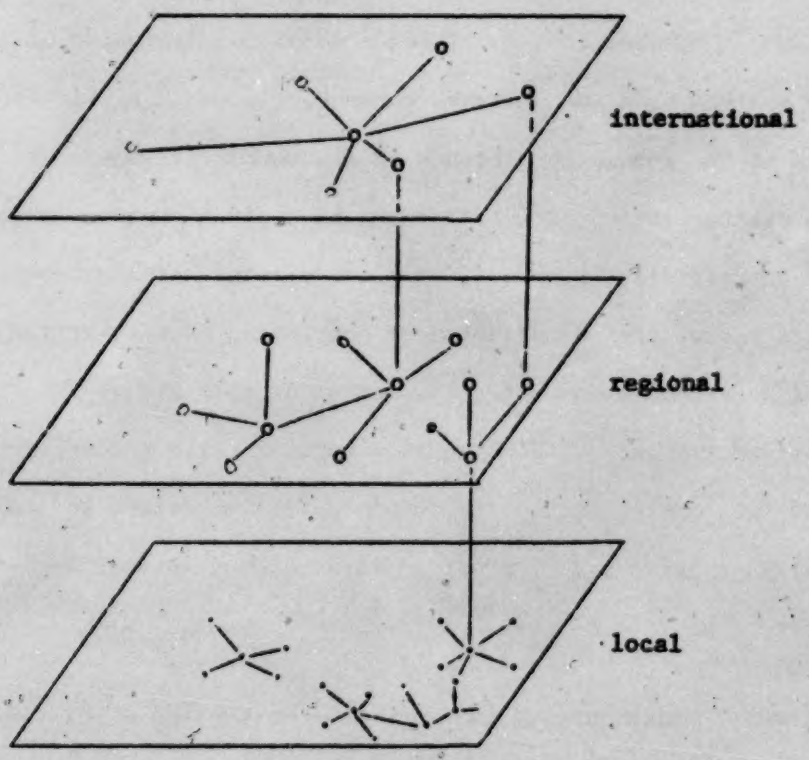

Figure 2. Hägerstrand's matrix of social communication displaying the flow down to the local levels (Small groups - individuals).
(From Hägerstrand 1962:8)

"The talking and listening individual is part of a huge, world-embracing network of links. Many observations suggest that this network has a definite spatial structure which probably is rather stable, that is, the links connect different places with probabilities which presumably change only slowly and thus are to some extent predictable. For the interpretation of areal differentiation within the anthropo sphere, it is a first-order necessity to inquire into this field." (Hägerstrand, 1967:7-8)

Hägerstrand developed a model for diffusion of innovations in a given area, on which he consequently based simulations. In his model, innovation spreads from a number of knowers at time 0, to others located in subdivisions of a given region. Probability of contact with knowers (either the original or consequent adopters) is a random process weighted by population density at the subdivision and a sort of a communication index for each link. This index is derived from some reflections of communicative interaction between any two *locales* such as telephone calls, migration and origin of marriage partners. The notion is developed further in Morrill and Pitts (1967), and is generally known as *mean information field.*

Communication density is seen to be a function of distance as well as physical and social barriers, as well.

Extent and characteristics of the diffusion at various time intervals as produced by the simulation are compared to

spatial propagation in the actual case and the results are striking.

Later versions of this model introduce further refinements, such as a resistance factor approximating reality closer. In the new model (*Figure 3*), adoption is not immediate upon awareness but requires a certain amount of persuation accomplished by repeated contacts.

Language diffusion is not unlike diffusion of cultural or other innovations and can be treated with a similar model. As an *item* we might take lexical units or any other variable (phonological, morphosyntactic traits, etc.). Material from atlases or language surveys can be used as data for the study of the process. Factors singled out for their importance in accounting for language variation (Fishman-Herasimchuk 1968, Labov 1966, etc.) must form an essential part of the model.

In integrating the social and the spatial aspects we must identify the channels which link the various networks (see *Fig. 3*). " . . . diffusion among individual farmers, the case on which Hägerstrand tested his theory, depends upon a local network of social communications. Diffusion viewed on a greater level of aggregation, such as through a landscape of central places, utilizes a different network of social communications, possibly one that is closely coordinated with the central place hierarchy." (Brown, 1968:14).

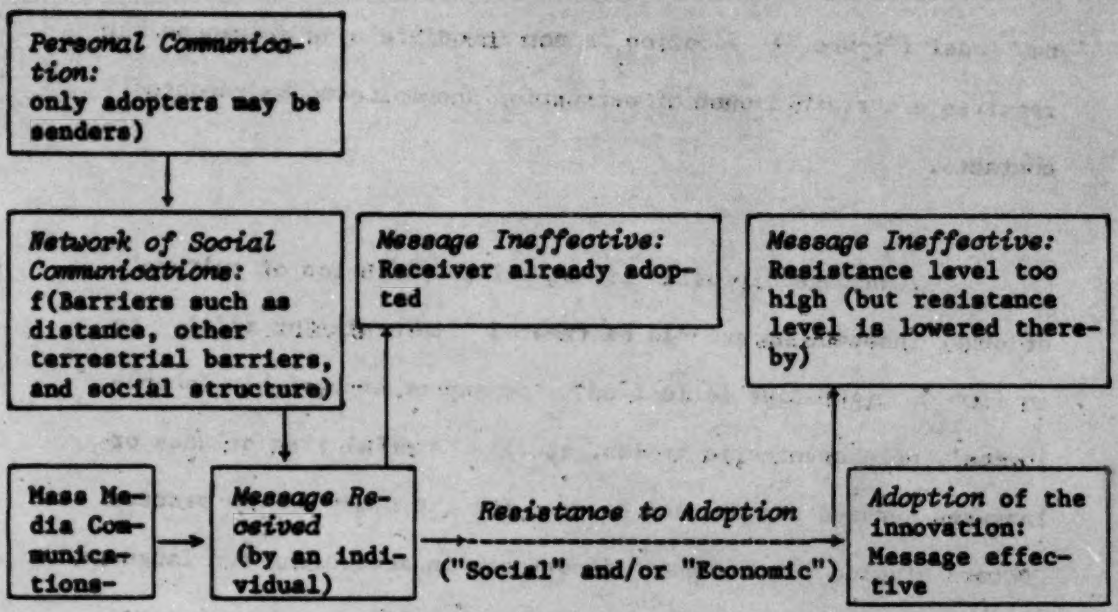

Figure 3. A flow diagram of Hägerstrand's conceptualization of the innovation diffusion process. (From Brown 1968:16)

What is meant here is that the information flow between cities, regions and such higher units does not obey the same constraints as the flow between individuals. In terms of linguistics, an innovation is seen to spread within a restricted area according to the existing network of personal communication but it must be carried to distant locales by different types of agents. These agents will be either the individuals acting on several levels (*Fig. 2*), or other agents such as education, mass media, etc. In any case the above individuals might well be in their position as members of a system of education, telecommunications, industry, government, etc. [8)]

4.0 Prediction

We can construct a model along the above general lines which treats both social and spatial diffusion. While the theoretical outline can be established with no particular difficulty, work needs to be done on the various components of such a model. Demographic data must be obtained from which to abstract statistical information on the social structure: age groups, classes, educational background, etc. Data on population density, and data for establishing indices of regional communication (Mean Information Fields or other such) must also be collected.

Meanwhile, work attempting prediction of change from sociodemographic data and a learning model for language has been carried on and should yield results in the immediate future (Klein, 1969). While this project does not draw so far on existing diffusion studies, it is nevertheless designed on partially similar principles.

A component on the internal mechanism-motivation of language change (e.g. Afendras et al., 1970e), can be added to generate potential innovations and a prediction model can be subsequently developed. An additional component on contact (drawing also on a theory of interference-prediction) with a second linguistic code and specifications for the sociolinguistic situation would enable us to predict:

a) generation of innovations from within one code, diffusion and integration in a subsequent *état* of this code,

b) innovations due to interference from the second code, their diffusion in the community and eventual integration into the original code (compare Tzannes and Afendras, 1970, Mackey 1970).

Manipulation of the sociodemographic parameters and other alterations could adapt the model to the prediction of language shift. Such a paradign can be extremely valuable for testing various theories of language change, language convergence (including phenomena of creolization) and shift, by the use of real data and the selective study of the effect on the outcome of various parameters. [9)]

5.0 Planning

As soon as the prediction model is working, it can be a very effective instrument for planning language policies. It can predict future linguistic situations both as to distribution of the codes in the population and as to the state of the codes themselves. If the situation desired by the language planners is divergent from that predicted, the parameters in the model can be changed until the two match. Naturally, some of the parameters (mostly the demographic ones) stay constant and the simulation should point out the extent of reinforcement (and area of application) for parameters such as education, mass media, etc.

Brown (1968, Ch. 3) has reviewed some recent efforts by geographers to integrate theories of diffusion and central place theories. In this work, adoption of innovations is seen to depend on (a) pertinent information, (b) the availability of the item itself. The latter depends in turn on the overall economy of the region and the spatial distribution of urban-economic centers and particular services. Brown develops a predictive quantitative model, as a refinement and extension of Hägerstrand's, which handles diffusion among central places.

For our purposes this extension is extremely useful be - cause it can contribute greatly to planning implementation of the language policy. It can assist in deciding with sociodemographic,

cultural, economic, and other criteria the geographic location of the different components of an educational system which bear directly on language. This would mean planning location and level of different schools or educational broadcasting for optimal spatial range. The curriculum could be planned by recourse to existing methods and theory (e.g. Mackey, 1969).

As far as language standardization is concerned, the planner will have to decide the "esthetic" questions. But once distributional optimality criteria for rival forms have been set by the planner, the model would assist wading through massive survey material to sort out preferred variants.[10)]

6.0 Conclusions

Work was reviewed and a possible model outlined for an interdisciplinary treatment of various linguistic phenomena. The model can be quantified and used in simulating the phenomena under scrutiny, for verification of the explanatory theory, prediction of future *états* and planning of policies.

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Addenda

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NOTES

1) The process of lexical borrowing is carefully examined by Haugen (1950). Of interest is his study of the effect on the innovation itself of its adoption by various subgroups of the community as it is diffused. Also, the shape of the innovation itself depending on the identity of the innovators (pp. 216 ff.).

2) *Ss* are asked to list lexical items which they feel belong to various conceptual fields. The cumulative frequency of the items for the group reflect their availability.

3) This must also be eventually related to Gumperz' assertion that *open networks* are the locus of change (in all its varieties) since personal switching which enhances change, is confined to open networks (1966:38). A statement of Weinreich, Labov and Herzog on language change (the transition problem) (1968:184) is also pertinent: "This transition or transfer of features from one speaker to another appears to take place through the medium of bidialectal speakers, or more generally, speakers with heterogeneous systems characterized by an orderly differentiation."

4) Both of these are illustrated by the different diffusion rates for various domains (or roles) in language shift. (See for instance Fishman 1969:14.)

5) Information from mass media and impersonal sources in general seems to be important for the awareness stage. In the evaluation stage, interpersonal communication is more important. (Rogers 1964:307, Coleman 1964:493.)

6) A simple example is the following: " . . . where a two-phoneme system is in contact with a merged one-phoneme system: . . . the direction of change will be in favor of the one-phoneme system . . ." (Weinreich et al., 1968:185.)

7) Weinreich (1953, 89 ff.) discusses *geographic areas* as one"socio-cultural division", i.e. variable determining language contact. Among other ideas he also discusses the effects of urbanization and migration on language convergence and maintenance. (His sections on INDIGENOUSNESS and CULTURAL OR ETHNIC GROUPS.) (Also cited in Fishman 1969:55 n. 40.)

8) On the interrelation between social and geographic dialects, see also Hans Kurath (1962), Haim Blanc (1964) and D. DeCamp (1961).

9) In spatial diffusion, for instance, the effect of physical barriers on rate or direction of spread have been studied. (Forrest Pitts, "Simulation Models in Human Geography". Mimeographed document, 1966.)

10) Björn Jernudd's (1968) "Case Study in the Sudan", and his proposals for an eventual language policy (planned diffusion of Arabic) is an excellent example of work profiting from principles laid down by diffusionists.